


Includes Amd # 1

KSC-SPEC-F-0006-A
2 June 1969
Supersedes
KSC-SPEC-F-0006
December 28, 1967

JOHN F. KENNEDY SPACE CENTER, NASA
HEAT AND BLAST PROTECTION
COATING MATERIALS, SPECIFICATION FOR

DESIGN ENGINEERING DIRECTORATE

APPROVED:

jm 
G. MERRITT PRESTON
DIRECTOR OF DESIGN ENGINEERING

OCT 17 1973

KSC-SPEC-F-0006A
AMENDMENT 1
November 4, 1970

JOHN F. KENNEDY SPACE CENTER, NASA
HEAT AND BLAST PROTECTION COATING MATERIALS,
SPECIFICATION FOR

This amendment forms a part of Kennedy Space Center Specification KSC-SPEC-F-0006-A, dated June 2, 1969, and is mandatory for use by KSC and associated contractors.

- (1) Page 2, paragraph 2.1, under specifications, add:

National Aeronautics and Space Administration

NHB 6000.1 Requirements for Packaging, Handling and Transportation for Aeronautical and Space Systems Equipment and Associated Components.

- (2) Page 2, paragraph 2.1, under Standards, Military, add:

MIL-STD-794, Appendix E Packaging of Kits (Parts and Modification)

- (3) Page 8, paragraph 5, delete and substitute:

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery shall be in accordance with NHB 6000.1 (1A). Unless otherwise specified, preservation and packaging shall be level A and packing shall be level C, as defined therein.

5.1.1 Additional marking requirements for each unit package (kit) and pack shall include:

- (a) Title, number and date of this specification
- (b) Class and type
- (c) Name of the product
- (d) Batch number
- (e) Manufacturer's name and address
- (f) Size of container
- (g) Date of manufacture

- (h) Toxic precautions
- (i) Necessary supplementary information to ensure safe and proper use of the material
- (j) ICC flammable label as required

5.1.2 Mixing and Application Instructions

Mixing and application instructions shall be included with each kit.

5.2 Quantity Unit - Pack

Unless otherwise specified, the material shall be furnished in two kit sizes as follows:

- (a) Large Kit - Shall contain the total constituent materials, which, when mixed and fully cured, will provide a minimum of 1110 cubic inches of the protective coating.
- (b) Small Kit - Shall contain the total constituent materials, which when mixed and fully cured, will provide a minimum of 222 cubic inches of the protective coating.
- (c) Where primer is required, it shall be included in each kit in a 4 or 16 ounce container for the small or large kits, respectively.

(4) Page 10, paragraph 6.2 (d), delete and substitute:

(d) Kit size (see 5.2)

C. J. Lodian:

NASA - J.F. Kennedy Space Center

Preparing Activity:

J. F. Kennedy Space Center

KSC-SPEC-F-0006-A
2 June 1969

JOHN F. KENNEDY SPACE CENTER, NASA
HEAT AND BLAST PROTECTION
COATING MATERIALS, SPECIFICATION FOR

This specification is mandatory for use by KSC and associated contractors.

1. SCOPE

1.1 Scope. - This specification covers general requirements for heat and blast protection coating materials for launch support equipment.

1.2 Classification. - Materials furnished under this specification shall be of the following classes and types as specified. (See 6.2)

Class 1 - Class 1 materials shall satisfy the LOX impact sensitivity requirements of MSFC-SPEC-106.

Class 2 - Class 2 materials are not required to meet the requirements of MSFC-SPEC-106 but must be fire retardant and self-extinguishing if ignited in air.

1.2.1 Class 2 materials shall be furnished in the following types, as specified. (See 6.2)

Type A - For application to bare and painted steel, and for refurbishment of silicone rubber surfaces.

Type B - For application to bare and painted steel, and for refurbishment of surfaces coated with materials conforming to Specification 75M12110.

KSC-SPEC-F-0006-A
2 June 1969

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on the date of issue of invitation for bids or requests for proposal form a part of this specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-H-5606

Hydraulic Fluid, Petroleum Base
Aircraft, Missile, and Ordnance

George C. Marshall Space Flight Center

MSFC-SPEC-106

Testing Compatibility of Materials
for Liquid Oxygen Systems

75M12110

Heat and Blast Protective Coating
Electrical Cables, Specification for

STANDARDS

Military

MIL-STD-129

Marking for Shipment and Storage

(Copies of specifications, standards, drawings, and publications required by the contractor in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other Publications. - The following document forms a part of this specification to the extent specified herein.

American Society for Testing Materials

D635-63 - Test for Flammability of Rigid Plastics Over 0.127 CM
(0.050 in.) in Thickness

(Application for copies should be addressed to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pennsylvania.)

3. REQUIREMENTS

3.1 Qualifications Tests. - Material supplied under this specification shall have been tested and have passed the qualification tests described in 4.3 for the class specified. Certification that material furnished under this specification is identical in composition and characteristics within commercial tolerances to the material which passed the qualification tests shall be furnished with each batch of material supplied.

3.2 Multicomponent Systems. - A coating system composed of different formulations (primer, basic coating, and topcoat) or forms (liquid, sheet and tape) shall satisfy the requirements of this specification as a complete system.

3.3 Shelf Life. - Material shall be capable of meeting the requirements of this specification for a minimum of six months after receipt by the procuring activity. Storage conditions at the requested point of delivery should be assumed to be within warehouses without control of temperature or humidity.

3.4 Ease of Application. - Material shall be capable of being applied by unskilled labor following detailed application procedures furnished by the material supplier. Trowelable materials shall be capable of being applied to a vertical surface to a thickness of 1/4-inch without sagging. Pot life shall be a minimum of one hour.

3.5 Adhesion. - Material shall adhere to bare steel and to steel coated with zinc-rich coating. Adhesion shall be a minimum of five pounds per linear inch when tested as described in 4.6.6.

3.5.1 Adhesion to Surfaces Coated with Silicone Rubber (Class 2, Type A only). - Class 2, Type A material shall exhibit a minimum peel strength of five pounds per linear inch when applied over the materials currently approved for use under Class 2, Type A of this specification and tested as described in 4.6.6.1.

3.5.2 Adhesion to Surfaces Coated with Material per Specification 75M12110 (Class 2, Type B only). - Class 2, Type B material shall exhibit a minimum peel strength of five pounds per linear inch when applied over material per specification 75M12110 and the materials currently approved for use under Class 2, Type B of this specification. Testing shall be as described in 4.6.6.2.

3.6 Cure. - The required cure for the material shall be complete within ten days at 50° to 100°F and 50 to 100 percent relative humidity.

3.7 Resistance to Penetration by Hydraulic Oil. - The surface of the cured material shall be smooth and nonporous. The material shall retain its thermal protection characteristics after exposure to hydraulic oil conforming to MIL-H-5606.

3.8 Rocket Engine Exhaust Resistance. - Material applied to designated areas of the launch facility to a thickness of 1/8-inch and then subjected to a Saturn V vehicle exhaust, shall not erode or burn through to the underlying surface. Remaining material shall adhere to the underlying surface. Backface temperature shall not exceed 250°F. Heat flux will be up to 280 Btu/sq. ft. sec., pressure 0.0 to 12.0 psig; time of exposure approximately 11 seconds.

3.9 Refurbishment. - Any char resulting from surface thermal decomposition shall be easily removed. Material which must be entirely removed before refurbishment is not acceptable. Resurfacing material must bond to the residual coating after the char has been removed. The bond must be homogeneous and show no tendency to delaminate under stress or vehicle exhaust.

3.10 LOX Impact Sensitivity. - LOX impact sensitivity shall be required in accordance with one of the following classes as specified.

Class 1 - Class 1 material shall be capable of satisfying the requirements of MSFC-SPEC-106.

Class 2 - Class 2 material is not required to satisfy the LOX impact sensitivity requirements of MSFC-SPEC-106. However, it must be fire retardant or self-extinguishing if ignited in air and must not react spontaneously with LOX.

3.11 Flammability. - Material shall be self-extinguishing in air when tested in accordance with 4.6.3.

3.12 Resistance to Hypergolic Propellants. - Material shall not ignite or produce a violent reaction with 50:50 UDMH - Hydrazine blend and nitrogen tetroxide when tested in accordance with 4.6.4.

3.13 Flexibility. - The coating shall be sufficiently flexible to permit wrapping a 1/8-inch thick sample around a 3-inch diameter mandrel without cracking when tested in accordance with 4.6.5.

3.14 Weathering. - The material shall resist degradation of thermal protection characteristics due to seacoast atmospheric exposure. Material installed at the John F. Kennedy Space Center and exposed to the elements for periods up to six months shall be capable of meeting the requirements of this specification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility. - Unless otherwise specified, the manufacturer is responsible for the performance of all inspection requirements specified herein. Except as otherwise specified, the manufacturer may utilize his own or any other inspection facilities and services acceptable to NASA. Inspection records of the examinations and tests shall be kept complete and available to the government for a period of five years, unless otherwise specified in the contract or order. The government reserves the right to perform any of the inspections set forth in the specification, where such inspections are deemed necessary, to ensure supplies and services conform to the prescribed requirements.

4.2 Quality Control. - The manufacturer shall establish and maintain an inspection system which satisfies the applicable requirements of National Aeronautics and Space Administration Quality Publication NPC 200-3.

4.3 Qualification Testing. - To become a qualified product, material shall meet the requirements of Section 3 and pass the qualification tests of 4.3.1 through 4.3.5.

4.3.1 LOX Impact Sensitivity Test (Class 1 only) of 4.6.1.

4.3.2 Rocket Engine Exhaust Test of 4.6.2.

4.3.3 Flammability Test of 4.6.3.

4.3.4 Hypergolic Propellant Compatibility Test of 4.6.4.

4.3.5 Flexibility Test of 4.6.5.

4.3.6 Adhesion Test of 4.6.6.

4.4 Acceptance Testing. - Production batches of Class 1 material shall be tested for LOX impact sensitivity as defined in 3.10 to determine acceptability. No acceptance test is required for Class 2 material.

4.5 Standard Test Conditions. - Standard conditions during testing shall be 70° plus or minus 5°F and 55 plus or minus 5 percent relative humidity.

4.6 Test Methods.

4.6.1 LOX Impact Sensitivity Test. - LOX Impact Sensitivity tests, when required, shall be performed in accordance with MSFC-SPEC-106. This test will be conducted by the John F. Kennedy Space Center, NASA.

4.6.2 Rocket Engine Exhaust Test. - Three test panels shall be attached to a location designated by the procuring activity. Test specimens shall consist of carbon steel panels, 6- by 6- by 1/8-inch, painted with zinc-rich coating, coated with 1/8 plus or minus 1/64-inch of the material to be tested. Alternatively, an area of the launch facility designated by the procuring activity shall be coated with 1/8-inch of the material to be tested. The specimens shall be cured at ambient conditions for at least the minimum time recommended by the manufacturer. The samples shall then be subjected to a Saturn V vehicle exhaust or other rocket engine exhaust acceptable to the procuring activity. After exposure the test samples shall not have eroded or burned through to the underlying surface. Material remaining shall adhere firmly to the underlying surface. Backface temperature shall not have exceeded 250°F. This test will be conducted by the John F. Kennedy Space Center, NASA.

4.6.3 Flammability Test. - Flammability testing shall be conducted in accordance with the method described in specification ASTM-D635. Specimen thickness shall be 1/8-inch.

4.6.4 Hypergolic Propellant Compatibility Test. - Compatibility with 50:50 UDMH - Hydrazine blend and nitrogen tetroxide shall be determined by the following method. Specimens 1- by 1- by 1/8-inch shall be placed in a dish and several drops of propellant shall be applied to simulate spillage. Exposure time shall be ten minutes. Evidence of flame or violent reaction shall be cause for rejection. This test will be conducted by the John F. Kennedy Space Center, NASA.

NOTE: Compatibility with the hypergolic propellants shall be determined with separate specimens.

4.6.5 Flexibility Test. - A sample 1/8- by 1- by 5-inches shall be wrapped around a mandrel 3-inches in diameter. Evidence of cracking shall be cause for rejection.

4.6.6 Adhesion Test. - One each of 1-inch wide samples of any convenient length and thickness of bare steel and steel coated with zinc-rich primer shall be coated with 1/8-inch of the material to be tested. T-peel strength

shall be a minimum of five pounds per linear inch when tested using a cross head travel speed of 20-inches per minute. Samples that exhibit a peel strength greater than the material tensile strength shall be considered to have passed the adhesion test.

4.6.6.1 Supplementary Adhesion Test (Class 2, Type A only). - One-inch wide samples of any convenient length and thickness of each of the currently qualified Class 2, Type A materials shall be overcoated with 1/8-inch of the material being tested. T-peel strength shall be a minimum of five pounds per linear inch when peel tested using a cross head travel speed of 20-inches per minute.

4.6.6.2 Supplementary Adhesion Test (Class 2, Type B only). - One-inch wide samples of any convenient length and thickness of each of the currently qualified Class 2, Type B materials and material conforming to specification 75M12110 shall be overcoated with 1/8-inch of the material being tested. T-peel strength shall be a minimum of five pounds per linear inch when peel tested using a cross head travel speed of 20-inches per minute.

4.7 Rejection and Retest. - Failure of any sample from any production lot to conform to the requirements of this specification shall be cause for rejection of the production lot represented.

4.8 Sampling for Production Lot Inspection. - Samples shall be selected from each production lot submitted for acceptance testing as required. Sufficient quantities of material shall be selected at random to permit testing as specified herein.

5. PREPARATION FOR DELIVERY

5.1 Packaging and Packing. - The compound shall be packaged level A or C and packed level A, B, or C, as specified.

5.1.1 Kit Size. - Unless otherwise specified in the contract or order, the coating shall be packed in kits which when mixed and fully cured shall provide a minimum coverage of 12.3 square feet by 1/8-inch for

small kits and 61.5 square feet by 1/8-inch for large kits, as specified. When primer is required, sufficient material shall be supplied with each kit.

5.2 Marking of Packaging and Packing Container. - Marking for identification shall be in accordance with MIL-STD-129. Each packaging and packing container shall display the following information:

- (a) Title, number, and date of this specification
- (b) Class and type
- (c) Name of the product
- (d) Batch number
- (e) Manufacturer's name and address
- (f) Size of container
- (g) Date of manufacture
- (h) Toxic precautions
- (i) Necessary supplementary information to ensure safe and proper use of the material

5.2.1 Mixing and Application Instructions. - Mixing and application instructions shall be included with each kit. Instructions may either be affixed to or enclosed within the packing container.

6. NOTES

6.1 Intended Use. - The material covered by this specification is intended to be used for protecting structural ground support equipment from rocket engine exhaust.

Class 1 materials are intended for use where contact with liquid oxygen (LOX) is expected. Such materials must be shielded from contamination in order to maintain them in a LOX impact insensitive condition.

Class 2 materials are intended for use where LOX exposure is unlikely and where the conditions necessary for ignition are not expected to be present even though LOX exposure is possible.

6.2 Ordering Data. - Procurement documents for the coating should specify the following:

- (a) Title, number, and date of this specification
- (b) Class and type of compounds required (See 1.2)
- (c) Whether special preservation, packaging, packing, and marking is required (See 5.1)
- (d) Kit size (See 5.1.2)

6.3 Provisions for Qualification. - With respect to products requiring qualification, awards will be made only for such products as have been tested and approved for inclusion into the applicable qualified products list prior to the bid opening date, whether or not such products have actually been listed by that date. The supplier's attention is called to this requirement, and manufacturers are urged to make arrangements for qualification testing of their product in order that they may be eligible for contracts to supply the products covered by this specification. Requests for information pertaining to qualification of products covered by this specification should be addressed as follows:

Design Engineering, DE-MSD
NASA/Kennedy Space Center
Kennedy Space Center, Florida 32899

Custodian:
NASA/John F. Kennedy
Space Center

Preparing Activity:
John F. Kennedy Space Center
Mechanical Systems Division

KSC-SPEC-F-0006-AMPL-6
June 18, 1984
Supersedes
KSC-SPEC-F-0006-AMPL-5
August 4, 1978

PRODUCTS APPROVED UNDER KSC SPECIFICATION

KSC-SPEC-F-0006

This list has been derived from a continuing test program. All listed materials have passed specific tests or service requirements of KSC-SPEC-F-0006, "Heat and Blast Protection Coating Materials, Specification For," and have been found to be satisfactory.

Class I - None approved.

Class II

Type A

<u>Product</u>	<u>Manufacturer</u>
Q3-6077	Dow Corning Corporation Midland, Michigan 48640
Chem Seal CS-3808	Flamemaster Corporation 11120 Sherman Way Sun Valley, California 91353-1458
SEA-200G	General Electric Co. Silicone Products Division 9119 Gaither Road Gaithersburg, Maryland 20877

Type B - None Approved.

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October 9, 1991
Supersedes
KSC-SPEC-F-0006-AMPL-6
June 18, 1984

PRODUCTS APPROVED UNDER KSC SPECIFICATION

KSC-SPEC-F-0006

This list has been derived from a continuing test program. All listed materials have passed specific tests or service requirements of KSC-SPEC-F-0006, "Heat and Blast Protection Coating Materials, Specification for," and have been found to be satisfactory.

Class I - None approved.

Class II

Type A

<u>Product</u>	<u>Manufacturer</u>
Q3-6077	Dow Corning Corporation 10330 Hercules Drive Freeland, MI 48623
Chem Seal CS-3808	Flamemaster Corporation 11120 Sherman Way Sun Valley, CA 91353-1458
CPC-1050 or Amercoat 3237	Ameron Protective Coatings 7757 Bayberry Road Jacksonville, FL 32256

Type B - None approved.